F

0350
#3

PATENT
#Y2-0221-UNI
Case #C7547(V)

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to:

"Assistant Commissioner for Patents
Washington, D.C. 20231"

on September 10, 2001

EDWARD A. SQUILLANTE, JR.
Reg. No. 38,319
Attorney for Applicant(s)

09/10/01
Date of Signature

OIPE SEP 17 2001 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Barnes et al.

Serial No.: 09/824,354

Filed: April 2, 2001

For: METHOD AND APPARATUS FOR GENERATING WATER SPRAYS, AND METHODS OF CLEANING USING WATER SPRAYS

Edgewater, New Jersey 07020
September 10, 2001

SUBMISSION OF PRIORITY DOCUMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Pursuant to rule 55(b) of the Rules of Practice in Patent Cases, Applicant(s) is/are submitting herewith a certified copy of the European Application No. 00302851.1 filed April 4, 2000, and European Application No. 00309011.5 filed October 13, 2000, upon which the claim for priority under 35 U.S.C. § 119 was made in the United States.

It is respectfully requested that the priority document be made part of the file history.

Respectfully submitted,

Edward A. Squillante, Jr.
Reg. No. 38,319
Attorney for Applicant(s)

EAS/mt
(201) 840-2925

Europäisches Patentamt
European Patent Office
Office eur péen des brevets

Bescheinigung Certificate Attestation

Die angehefteten Unterlagen stimmen mit der ursprünglich eingereichten Fassung der auf dem nächsten Blatt bezeichneten europäischen Patentanmeldung überein.

The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr. Patent application No. Demande de brevet n°

00302851.1

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

I.L.C. HATTEN-HECKMAN

DEN HAAG, DEN
THE HAGUE, 05/04/01
LA HAYE, LE

Europäisches Patentamt | European Patent Office | Office européen des brevets

Blatt 2 der Besch inigung
Sheet 2 of the certificate
Page 2 de l'attestation

Anmeldung Nr.:
Application no.:
Demande n°: 00302851.1

Anmeldetag:
Date of filing: 04/04/00
Date de dépôt:

Anmelder:
Applicant(s):
Demandeur(s):
Unilever N.V.
3130 AC Vlaardingen
NETHERLANDS

Bezeichnung der Erfindung:
Title of the invention:
Titre de l'invention:
Cleaning spray apparatus

In Anspruch genommene Priorität(en) / Priority(ies) claimed / Priorité(s) revendiquée(s)

Staat: State: Pays:	Tag: Date: Date:	Aktenzeichen: File no. Numéro de dépôt:

Internationale Patentklassifikation:
International Patent classification:
Classification internationale des brevets:
B05B7/04, B08B3/02

Am Anmeldetag benannte Vertragstaaten:
Contracting states designated at date of filing: AT/BE/CH/CY/DE/DK/ES/FI/FR/GB/GR/IE/IT/LI/LU/MC/NL/PT/SE/TR
Etats contractants désignés lors du depôt:

Bemerkungen:
Remarks:
Remarques:

CLEANING SPRAY APPARATUS

This invention relates to a cleaning spray apparatus.

In practical applications such as the cleaning of food manufacturing and processing plants the use of liquid spray cleaning apparatus is well known and there are known in the art various forms of such apparatus incorporating the use of pressurised liquids and gases to effect cleaning.

Most conventional liquid spray cleaning apparatuses involve the atomisation of cleaning liquid into small, high velocity droplets, e.g. of less than 50µm diameter, in order to exert their cleaning effect. A problem with such known systems however is that air drag over distances of as little as 1 or 2 metres can significantly reduce the droplet velocity and thus the cleaning effect.

To counteract this phenomenon it may be possible to simply increase the pressure of the liquid (e.g. water) being supplied to the pressurised cleaning nozzle. However, although that can generate higher velocities, it results in formation of droplets of smaller size, which have lesser cleaning power on what are typically surface soils. An alternative technique to this which is already known is the use of air as a means of atomising the liquid droplets emerging from the nozzle.

Two main classes of nozzle exist where air is used to provide atomisation. One example is an internal air assist nozzle where air is introduced into the liquid stream within a mixing chamber within the body of the nozzle. Another example is an external air assist nozzle where high velocity air impinges on the liquid as it emerges from the mouth of the nozzle so as to atomise it. Generally air is used to create small droplets of low velocity (less than

about 50μm diameter) for the formation of fogs or mists used in combustion, cooling and chemicals processes. Air assist spray nozzles however, can offer a wider range of spray patterns, flow rates and degrees of atomisation, as is well documented in the art.

Hitherto, however, there has not been adequately addressed the above-mentioned problem of reduced liquid droplet velocity upon atomisation with entrained air.

Published European patent application EP-A-0294690 discloses a low flow rate pressure atomiser device in which aqueous cleaning solution is injected into a tube, around a portion of which a second tube is arranged carrying a pressurised gas. The velocity of the gas, which is accelerated to substantially sonic velocity within the tube, with a disclosed volumetric liquid to gas flow rate of at most 1/1000 and a liquid flow rate of less than about 30ml/min, atomises the liquid flow as it passes down and out of an acceleration tube for impact with a surface to be cleaned. However still this low flow rate pressure atomiser device is limited in its ability to provide optimum cleaning power, which we have found to be symptomatic of the disclosed gas atomisation-effecting velocity and volumetric liquid to gas flow rates.

Accordingly, in a first aspect the present invention provides a cleaning apparatus comprising a nozzle for carrying a pressurised flow of cleaning liquid to an outlet thereof, and a conduit surrounding the nozzle outlet for carrying a flow of gas contiguously around the flow of cleaning liquid exiting said nozzle outlet.

A primary feature of the apparatus according to the invention is the contiguous nature of the gas flow around the jet of cleaning liquid exiting the nozzle outlet, which

means that the gas flow is not directed to breaking up the stream of liquid exiting the nozzle. This is in contrast with conventional atomiser apparatuses and enables the attainment of unusually high liquid flow rates in combination with relatively large liquid droplet sizes.

In other words, the apparatus of the invention represents a novel type of air-assist nozzle in which the gas does not play a part in the atomisation process, but instead flows co-currently in a shroud around the jet of cleaning liquid exiting the central nozzle. This prevents the droplets of liquid undergoing significant deceleration in their travel to a target to be cleaned, since their momentum is substantially maintained.

In preferred embodiments of the apparatus of the present invention the various parameters as listed below are preferably selected as follows for optimisation of the apparatus' performance in cleaning a target surface:

(i) Droplet size

In preferred embodiments the droplet size of the liquid exiting the nozzle is greater than 50μm. By virtue of this relatively large droplet size, coupled with the droplets' relatively high velocity arising from the other preferred parameters of the system, increased cleaning performance is obtainable.

(ii) Liquid to gas flow rate

In preferred embodiments the volumetric liquid to gas flow rate ratio is in the range 1/200-1/600, more preferably in the region of 1/300, for optimal cleaning, based on a preferred liquid flow rate of 14 to 28 l/min and a preferred liquid pressure of 2 to 3 bar.

A preferred embodiment of the apparatus of the present invention will now be described in further detail with reference to the accompanying drawings, in which:

Figure 1 is a cross sectional view of the apparatus according to the preferred embodiment;

Figure 2 shows an end view (a) and side view (b) of the preferred liquid nozzle incorporated in the apparatus of Figure 1; and

Figure 3 is a schematic cross sectional view of the preferred apparatus of Figure 1, along arrow "A".

The preferred apparatus according to the invention as shown schematically in the drawings comprises a pneumatic air mover 4 comprising air inlet 20 and delivery conduit 12 which surrounds the outlet portion 7 of the cleaning liquid nozzle 6, which is in communication with the main liquid delivery pipe 8, into which cleaning liquid is supplied through inlet 10 through a suitable conventional pressure inlet source (not shown). In the preferred embodiment the air mover 4 is a Model RJ50A Ringjet Airmover from O.N. Beck & Co Ltd, which is able to produce an air jet of a peak exit velocity of around 25 ms^{-1}.

In this embodiment the delivery conduit 12 of the air mover 4 has an internal diameter of 67 mm, enabling the distance between the nozzle outlet portion 7 and the mouth 14 of the delivery conduit 12 to be approximately 1 to 120 mm. The air supply is provided by mains compressed air at a pressure of up to 4.0 bar, although variation in the outlet air velocity is possible by a adjustment of the air mover setting. By way of example, the air mover 4 may be tuned to produce a maximum air velocity exiting the conduit 12 at 3.0 bar, which gives a mean air velocity measured 100 mm

from the outlet conduit mouth 14 ranging from 11.0 ms^{-1} (at an air pressure of 1.0 bar) to 22.5 ms^{-1} (at an air pressure of 4.0 bar).

By way of example, an optimum setting of the above described apparatus was obtainable using a 4.8 bar water pressure exiting the liquid nozzle 6, in combination with a 2 to 3 bar air pressure setting of the air mover 4.

The above mentioned settings may of course be varied in order to maximise the cleaning effect of the liquid stream exiting the nozzle, shrouded by the accompanying flow of air from the surrounding conduit, in order to obtain an optimum cleaning power as may be demanded by the application for which the apparatus is intended.

CLAIMS

1. A cleaning apparatus comprising a nozzle for carrying a pressurised flow of cleaning liquid to an outlet thereof and a conduit surrounding the nozzle outlet for carrying a flow of gas contiguously around the flow of cleaning liquid exiting said nozzle outlet.

2. A cleaning apparatus according to claim 1, wherein the size of the liquid droplets exiting the nozzle is greater than 50μm.

3. A cleaning apparatus according to claim 1 or claim 2, wherein the volumetric liquid to gas flow ratio is in the range 1/200 - 1/600.

ABSTRACT

CLEANING SPRAY APPARATUS

A cleaning apparatus comprising a nozzle (6) for carrying a pressurised flow of cleaning liquid to an outlet (7) thereof, and a conduit (12) surrounding the nozzle outlet (7) for carrying a flow of gas contiguously around the flow of cleaning liquid exiting said nozzle outlet (7).

Figure 1.

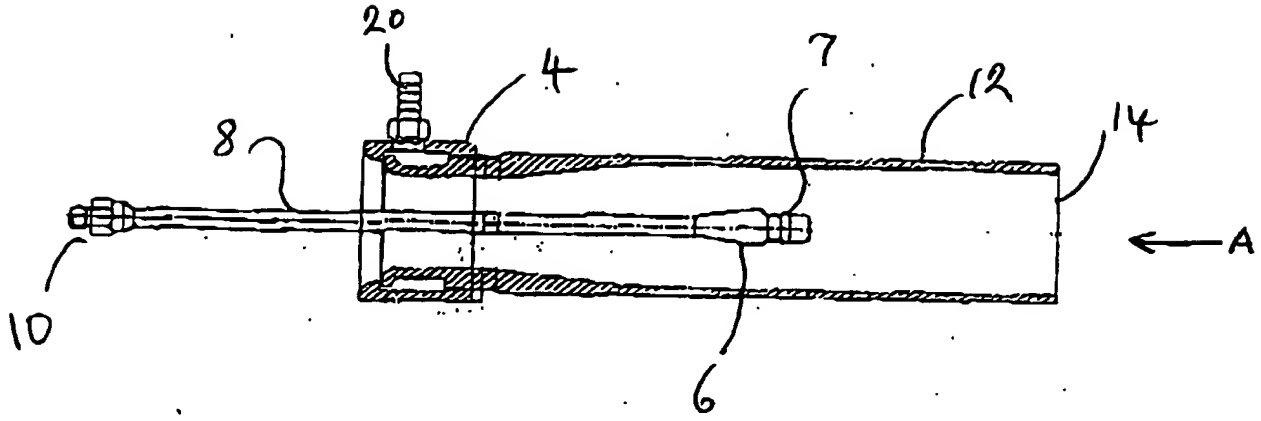

Fig. 1

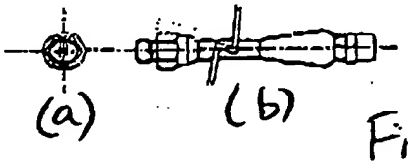

Fig. 2

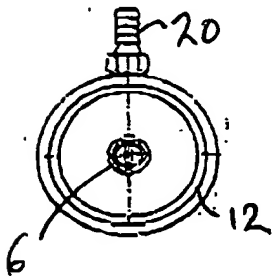

Fig. 3